

## Focus on Application of Photons and Radicals for Mass Spectrometry, Honoring Dr. Ryan Julian, Recipient of the 2017 ASMS Biemann Medal

This special focus issue of the *Journal of the American Society for Mass Spectrometry* celebrates the accomplishments of Professor Ryan R. Julian, the recipient of the 2017 ASMS Biemann Medal. Ryan is a professor in the Department of Chemistry, University of California, Riverside.

He received a B.S. degree in Chemistry from the University of Utah (Salt Lake City, UT), where he did undergraduate research on high-resolution resonant two-photon ionization spectroscopy and computational modeling for metal-rare gas complexes with Professor William H. Breckenridge. He then went on to the California Institute of Technology (Pasadena, CA) to earn his Ph.D. in Chemistry in 2003, where he studied gas phase chemical reactions and supramolecular interactions utilizing mass spectrometry, under the supervision of Professor J. L. (Jack) Beauchamp. Following Caltech, Ryan did postdoctoral research at Indiana University, working with both Professors Martin Jarrold and David Clemmer; he gained research experience in protein structure, chirality, small molecular clusters, viruses, proteomics, ion trajectory simulations, and ion mobility spectrometry during his time in Indiana before starting his independent career at UC Riverside in 2005. In addition to receiving the Biemann Medal, he has been recognized with the ASMS Research Award in 2006 and an NSF CAREER Award in 2008. Ryan was selected as one of the Best Reviewers in 2010 for *JASMS*, and he has served as a member of the Editorial Board for *JASMS* (2011–2016).

Ryan has made significant contributions to develop and exploit photo-initiated gas phase radical ion chemistry to probe peptide and protein structure. Several applications that rely on this chemistry have been developed by Ryan's lab, including methods for (1) examining the three-dimensional structure of proteins in the gas phase; (2) site-specific identification of serine and threonine phosphorylation; (3) identification of cysteine residues and disulfide pairs (bonds); (4) identification of peptide epimers; (5) oligosaccharide characterization; and (6) monitoring energy transfer with ultraviolet (UV) action spectra.

His research group has uniquely developed bond selective chemistry for initiating controllable “footprinting” with a technique that he calls radical directed dissociation (RDD). This is accomplished by photoexcitation with UV photons, leading to homolytic dissociation of specific bonds and the generation of a radical species. For example, photodissociation of carbon-iodine bonds with 266-nm photons occurs with high yield due to excitation of a dissociative excited state. If the carbon is covalently attached to a



ASMS President Vicki Wysocki (left) presenting the Biemann Medal to Ryan Julian at the 2017 ASMS Conference (Indianapolis, IN)

protein, then a radical is generated at that atom, and iodine radical is lost. The Julian lab has demonstrated that this chemistry can be used to create radicals in various types of biomolecules via dissociation of carbon-iodine, carbon-sulfur, and sulfur-sulfur bonds associated with numerous chromophores. Importantly, any of these bonds can be photodissociated regardless of molecular size, charge state, charge polarity, or sequence. The specificity inherent with this method allows for precise placement of an active radical in a controllable location, which can subsequently initiate fragmentation of the molecule via radical directed dissociation.

The following questions posed to Ryan and his responses to the questions should allow readers to learn more about Ryan's background and motivations.

*Q: Currently, you're a Professor of Chemistry at UC Riverside, and your research is focused on new techniques utilizing mass spectrometry and spectroscopy to study biological systems including protein dynamics and structure, molecular recognition, radical directed dissociation, and*

*aging. Let's explore how you arrived here. When you were a kid, did you ever imagine you would be a scientist?*

*Ryan:* Yes. In elementary school, my parents bought me an elaborate chemistry set. I tried mixing every combination of reagents to make an explosive, but failed. It was very disappointing, but I guess I have always enjoyed experimenting around with things. I was also lucky to be inspired by great middle and high school teachers.

*Q: How did you decide to attend the University of Utah and to be a chemistry major?*

*Ryan:* My parents divorced when I was four, and I grew up with my dad. I went to Utah to spend some time with my mom while getting my bachelor's degree. I started out as a pre-med biology major, but my first biology class was a disorganized disaster. My first chemistry class was awesome, so I switched to chemistry and pre-law (intellectual property sounded interesting). A year later I started doing research in the Breckenridge lab and never looked back. In retrospect, I was very lucky because Utah has an outstanding chemistry program for undergraduates.

*Q: So after graduating from Utah, what were you thinking at the time to get a Ph.D., and ultimately attend Caltech?*

*Ryan:* After living in Utah for a few years, I was ready to try California (cue 2Pac and Dr. Dre, California Love). I really didn't know what I was going to do with a Ph.D., but I figured that would sort itself out.

*Q: What was it like at Caltech and working for Jack (Beauchamp)?*

*Ryan:* Caltech is an unbelievable bastion of science, and full of amazing people. I truly enjoyed my time there. When I toured Jack's lab during my first visit, I encountered mass spectrometry and began to feel its *magnetic* lure pulling me in. Maybe it was just the 7 Tesla unshielded magnet, but I couldn't escape.

*Q: Did you ever explore a career besides academia? What led you to your current position at UCR?*

*Ryan:* I actually applied for a few government jobs, including several with intelligence agencies. I guess they figured I wasn't spy material since I never heard back from any of them. I interviewed at a handful of universities, but the chemistry department at UCR was most in-sync with what I wanted to do. I think it is important to go where your skills and talents are appreciated.

*Q: What advice do you give students today about careers?*

*Ryan:* First, I think mass spec is in a good place to secure a great career in many different fields. Second, there are a lot of options out there, so explore broadly and talk to a

lot of people. Get to know the experts/leaders in different areas while you are student. Relationships will help you in life just as much as your training.

*Q: You have authored two science fiction books (Mind Strings and The Silent Gene). How do you find the time? How did your writing career start?*

*Ryan:* I think it is important to have diverse interests to keep the mind fresh. My writing career started at the age of 7 when I wrote my first short story. It was about two kids walking to school in Alaska and who were attacked by an angry moose (don't worry, they outsmarted it). Since then, I have always wanted to write a book. So about six years ago, I started slowly writing one in my 'spare time'. That book felt lonely, so I wrote another and published them recently on Amazon. It was an interesting experience and I learned a lot. It has also been useful for my research, inspiring new directions (like studying aging), and digging into the art of writing has helped me tremendously.

*Q: What's next for the Julian Lab? Anything interesting on the horizon?*



Ryan Julian delivering his Biemann Medal presentation at the 2017 ASMS Conference (Indianapolis, IN)

*Ryan:* I think old proteins are much more important than people have recognized to date, so we'll continue to shed light on that subject. I also have some ideas related to Alzheimer's and other neurological diseases. Hopefully, the future will see part of my lab moving in that direction.

The subject of this Special Focus Issue is to feature applications of photons and radicals to advance mass spectrometry-based research, with invited articles contributed by Ryan's friends and colleagues. Ryan has built an impressive research program based on radical chemistry and mass spectrometric methodologies, and he is pointing his strategies to address applications of high impact to both the biology and chemistry communities. On Amazon's website, Ryan describes himself as "an international best-selling, award-winning author." He's not really serious about the "international best-selling" tag (although *technically*, he's correct—you'll need to read the full description to judge). And he was being very modest about the "award winning" aspect of his career, but this description is now very *accurate*. On behalf of the editors of *JASMS* and Ryan's friends and former and present colleagues, I congratulate Ryan for his much deserved Biemann Medal.



Ryan "Radical" Julian demonstrating how radicals are captured by his RDD technique

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